

## CLAIMS

- Sub 55
1. A wireless communication system, comprising:  
transmitter circuitry comprising encoder circuitry for receiving a plurality of symbols;  
a plurality of antennas coupled to the transmitter circuitry and for transmitting  
5 signals from the transmitter circuitry to a receiver, wherein the signals are responsive to the plurality of symbols; and  
wherein the encoder circuitry is for applying open loop diversity and closed loop diversity to the plurality of symbols to form the signals.
2. The system of claim 1:  
wherein the plurality of antennas comprises a plurality of sets of antennas; and  
wherein for each of the sets of antennas the encoder circuitry is for applying open  
loop diversity to selected ones of the plurality of symbols such that signals transmitted by  
5 any one antenna in the set of antennas represent open loop diversity with respect to signals transmitted by any other antenna in the set of antennas.
3. The system of claim 2 wherein for each of the sets of antennas the encoder circuitry is for applying a weight to the plurality of symbols such that signals transmitted in response to the weight represent a closed loop diversity with respect to signals transmitted by any other antenna in any other of the sets of antennas.
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4. The system of claim 3:  
wherein the plurality of sets of antennas consists of two sets of antennas; and  
wherein each of the sets of antennas consists of two antennas.
5. The system of claim 3:  
wherein the plurality of sets of antennas consists of three sets of antennas; and  
wherein each of the sets of antennas consists of two antennas.

6. The system of claim 3:  
wherein the plurality of sets of antennas consists of two sets of antennas; and  
wherein each of the sets of antennas consists of four antennas.
7. The system of claim 3:  
wherein the plurality of sets of antennas consists of four sets of antennas; and  
wherein each of the sets of antennas consists of two antennas.
8. The system of claim 1 wherein the open loop diversity comprises space  
time block coded transmit antenna diversity.
9. The system of claim 1 wherein the open loop diversity comprises  
orthogonal transmit diversity.
10. The system of claim 1 wherein the open loop diversity comprises time  
switched time diversity.
- <sup>6</sup>  
~~11.~~ The system of claim 1 wherein the closed loop diversity comprises transmit  
adaptive array diversity.
12. The system of claim 11 wherein the open loop diversity comprises space  
time block coded transmit antenna diversity.
- <sup>7</sup>  
~~13.~~ The system of claim 1 and further comprising the receiver.
- <sup>8</sup> <sup>7</sup>  
~~14.~~ The system of claim ~~13~~ wherein the receiver comprises one antenna for  
receiving the signals transmitted from the plurality of antennas.

<sup>9</sup>  
~~15.~~ The system of claim ~~13~~<sup>7</sup> wherein the receiver comprises a plurality of antennas, wherein each of the plurality of antennas is for receiving the signals transmitted from the plurality of antennas.

<sup>10</sup>  
~~16.~~ The system of claim ~~13~~<sup>7</sup> wherein the receiver comprises decoder circuitry for decoding open loop diversity and closed loop diversity with respect to the plurality of symbols.

<sup>11</sup>  
~~17.~~ The system of claim ~~16~~<sup>10</sup> wherein the receiver further comprises:  
 a despreader having an output and for producing a despread symbol stream at the output in response to the signals, wherein the output is coupled to the decoder circuitry;  
 a channel estimator coupled to the output of the despreader and for determining  
 5 estimated channel impulse responses based on the despread symbol stream; and  
 wherein the decoder circuitry is for decoding open loop diversity and closed loop diversity with respect to the despread symbol stream and in response to the estimated channel impulse responses.

<sup>12</sup>  
~~18.~~ The system of claim ~~17~~<sup>11</sup> wherein the receiver further comprises a deinterleaver coupled to an output of the decoder circuitry and for providing an inverse interleaving function with respect to information received from the decoder circuitry.

<sup>13</sup>  
~~19.~~ The system of claim ~~18~~<sup>12</sup> wherein the receiver further comprises a channel decoder coupled to an output of the deinterleaver and for improving a data error rate of information received from the deinterleaver.

<sup>14</sup>  
~~20.~~ The system of claim 1 wherein the signals comprise CDMA communications.

<sup>15</sup>  
~~21.~~ The system of claim 1 wherein the signals comprise WCDMA communications.

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<sup>16</sup>  
~~22.~~ The system of claim 1 wherein the signals comprise TDMA communications.

<sup>17</sup>  
~~23.~~ The system of claim 1:  
wherein the transmitter circuitry is located in a base station; and  
wherein the receiver comprises a mobile receiver.

<sup>18</sup>  
~~24.~~ The system of claim 1 wherein the plurality of symbols comprise quadrature phase shift keying symbols.

<sup>19</sup>  
~~25.~~ The system of claim 1 wherein the plurality of symbols comprise binary phase shift keying symbols.

<sup>20</sup>  
~~26.~~ The system of claim 1 wherein the plurality of symbols comprise quadrature amplitude modulation symbols.

<sup>21</sup>  
~~27.~~ The system of claim 1 wherein the transmitter circuitry further comprises:  
a channel encoder for receiving a plurality of bits;  
an interleaver coupled to an output of the channel encoder and for shuffling a block of encoded bits; and  
5 a symbol mapper coupled to an output of the interleaver for converting shuffled bits into the plurality of symbols.

28 A wireless communication receiver for receiving signals from transmitter circuitry transmitting along a plurality of transmit antennas, wherein the signals are formed by the transmitter circuitry by applying open loop diversity and closed loop diversity to a plurality of symbols, the receiver comprising:

5 a despreader having an output and for producing a despread symbol stream at the  
output in response to the signals; and

decoder circuitry coupled to the output of the despreader and for decoding open loop diversity and closed loop diversity with respect to the despread symbol stream.

<sup>23</sup>  
~~29.~~ The receiver of claim <sup>22</sup>~~28~~ and further comprising one antenna for receiving the signals transmitted from the plurality of transmit antennas.

~~20.~~<sup>24</sup> The receiver of claim ~~28~~<sup>22</sup> and further comprising a plurality of antennas for receiving the signals transmitted from the plurality of transmit antennas.

31. The receiver of claim 28 and further comprising:  
a channel estimator coupled to the output of the despreader and for determining estimated channel impulse responses based on the despread symbol stream; and

wherein the decoder circuitry is for decoding open loop diversity and closed loop  
5 diversity with respect to the despread symbol stream and in response to the estimated  
channel impulse responses.

~~26~~ <sup>25</sup> The receiver of claim ~~31~~ and further comprising a deinterleaver coupled to an output of the decoder circuitry and for providing an inverse interleaving function with respect to information received from the decoder circuitry.

<sup>27</sup>  
~~38.~~ The system of claim <sup>26</sup>~~32~~ and further comprising a channel decoder coupled to an output of the deinterleaver and for improving a data error rate of information received from the deinterleaver.

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34. A method of operating a wireless communication system, comprising the steps of:

5 receiving a plurality of symbols into encoder circuitry;

applying open loop diversity and closed loop diversity to the plurality of symbols to form a plurality of signals; and

transmitting the plurality of signals along a plurality of antennas to a receiver.

35. The method of claim 34:

wherein the plurality of antennas comprises a plurality of sets of antennas; and

wherein the step of applying open loop diversity and closed loop diversity applies open loop diversity to selected ones of the plurality of symbols such that signals

5 transmitted by any one antenna in the set of antennas represent open loop diversity with respect to signals transmitted by any other antenna in the set of antennas.

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36. The method of claim 35 wherein for each of the sets of antennas the step of applying open loop diversity and closed loop diversity applies a weight to the plurality of symbols such that signals transmitted in response to the weight represent a closed loop diversity with respect to signals transmitted by any other antenna in any other of the sets

5 of antennas.

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